Integrated Metrics for CMMI[SM]

Gary Natwick
Harris Corporation
Melbourne, Florida

[SM] - CMMI is a service mark of Carnegie Mellon University

Organization

Government Communications Systems Division

- $848M in Sales
- 5,400 Employees
- ISO 9001
- SEI Level 3

Aerospace and Ground Communication Systems

- Technology Systems
- Ground Systems
- Aerospace Systems

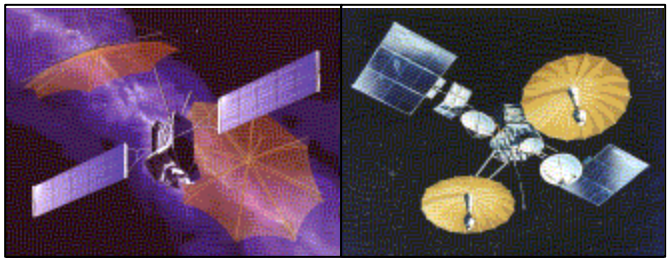
Integrated Information Communication Systems

- Processing Systems
- Information and Transportation Systems
- Harris Technical Services

Strategic Management and Business Development

- Technology and Advanced Programs
- Research and Development
- Business Development
- Field Marketing
- Mergers and Acquisitions
- Strategic Planning

Application Domains



- Space Systems
- Precision Structures
- Phase Arrays
- Processors

- Avionics Subsystems
- Fiber Optic MUX/DEMUX
- Displays
- Digital Maps

- Satellite Communication Systems
- Exploitation
- Exfiltration
- Wireless Systems

- Ground Stations (C2 and TTC)
- Enterprise Management Systems

- Image Processing and Visualization
- Mission Operations
- Signal Processing
- Optical Processing

Goal-Question-Measurement (GQM)

Business Goals

↓

Measurement Goals

↓

Questions

↓

Measures

What are our business goals?

- Improve customer satisfaction by reducing defects.

What do we want to achieve in order to satisfy our business goals?

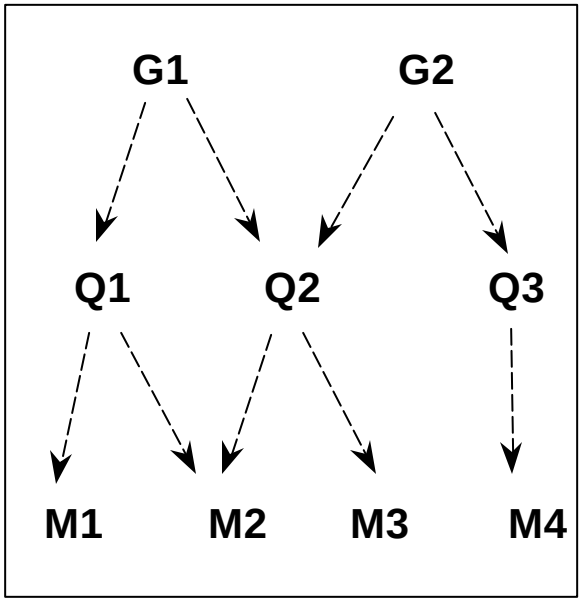
- Reduce post-delivery defects to “N” per KLOC

What questions will help us plan & manage progress toward our goals?

- Where are defects introduced & removed?
- How effective are peer reviews?

What measures are necessary to answer these questions?

- Defects detected in peer reviews, testing ...
- Defect categorization, rework time ...



The question is not:

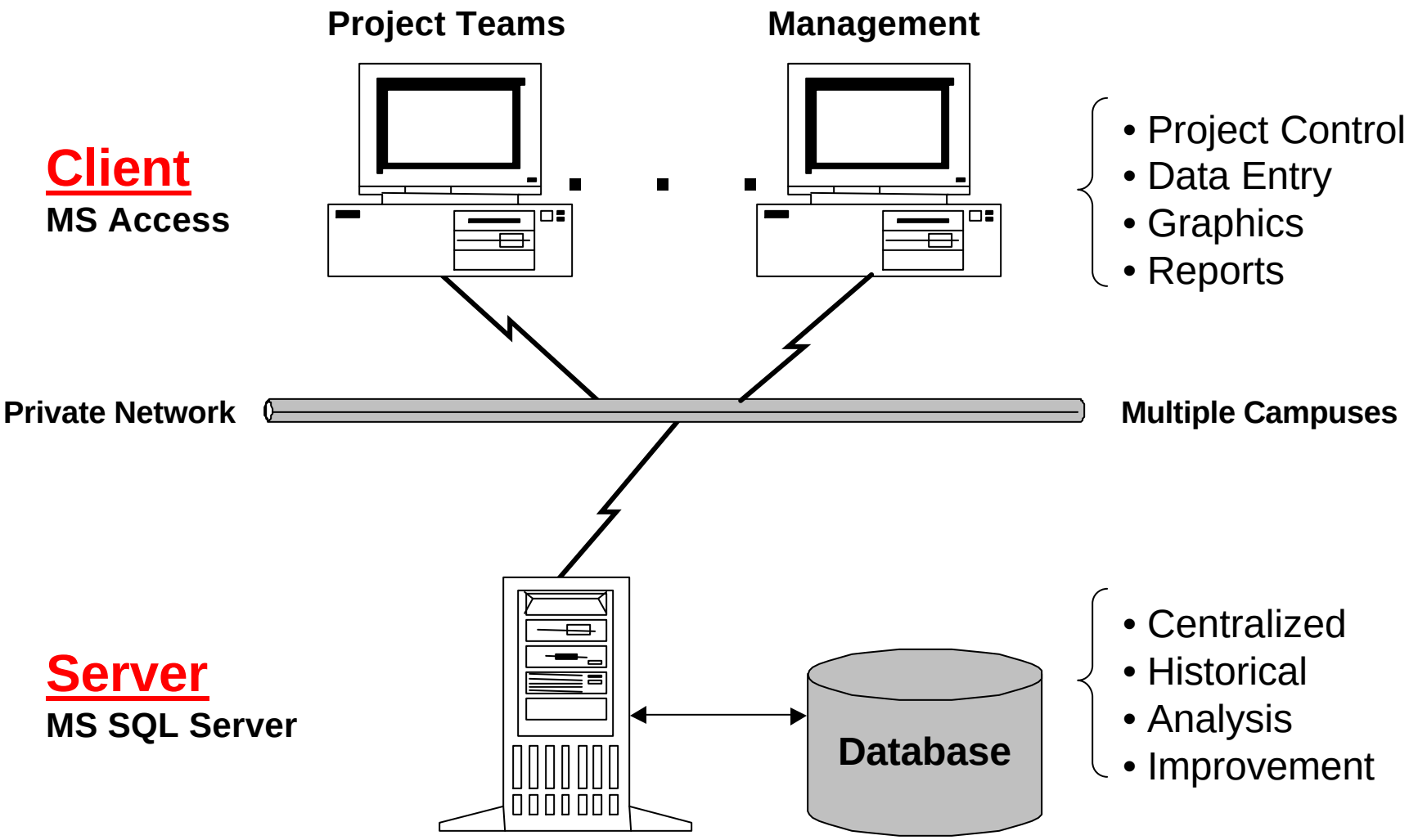
What metrics should I use?

Rather:

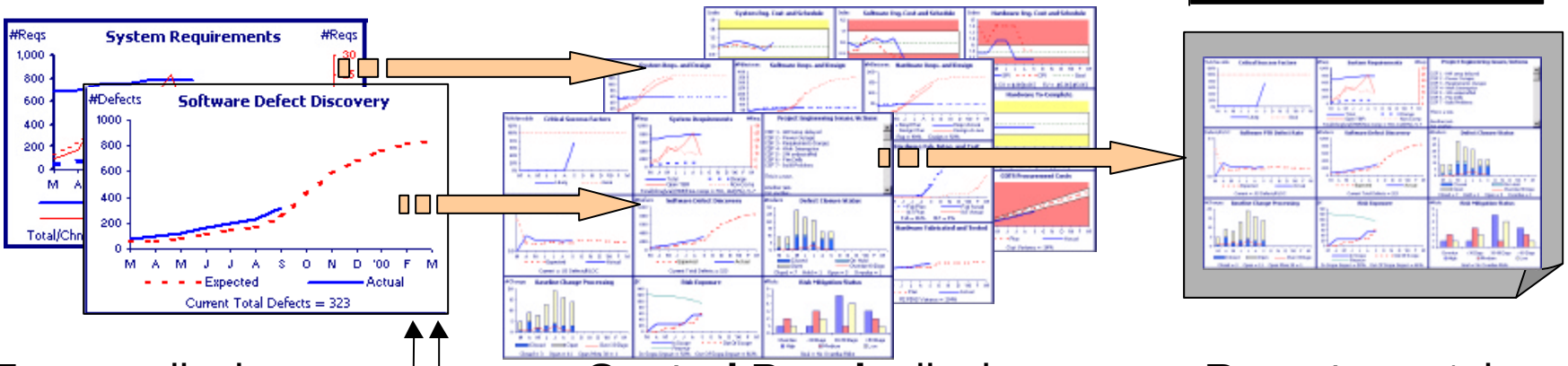
What do I want to know or learn?
Why are we collecting the data?
How do we use the data?

Adapted from: Goal-Driven Software Measurement - A Guidebook, Park et al., CMU/SEI-96-HB-002, August 1996.

Architecture



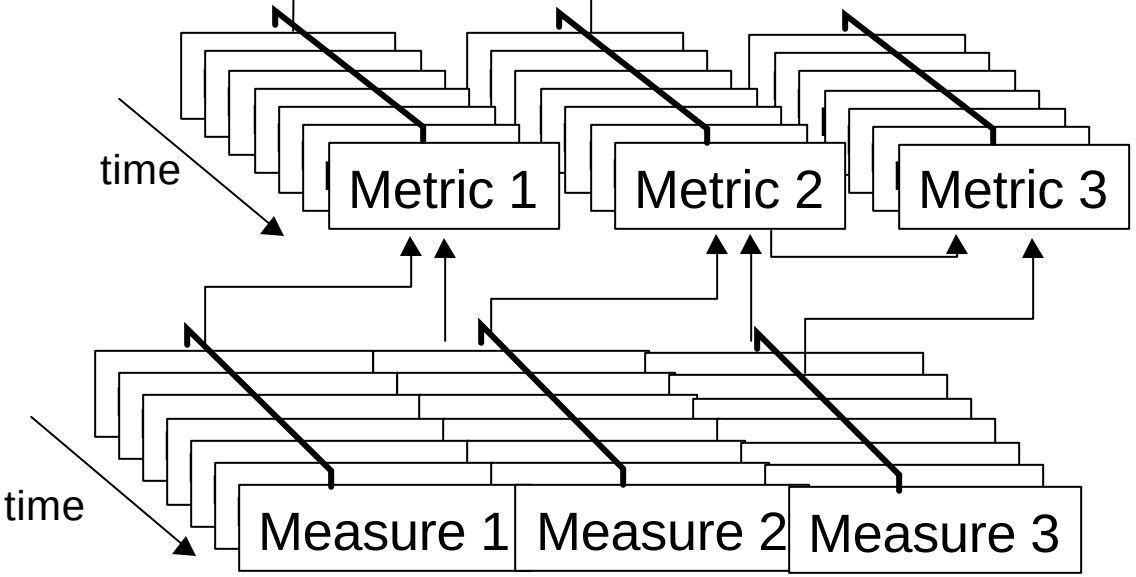
Project Engineering Metrics



Frames display one or more metrics

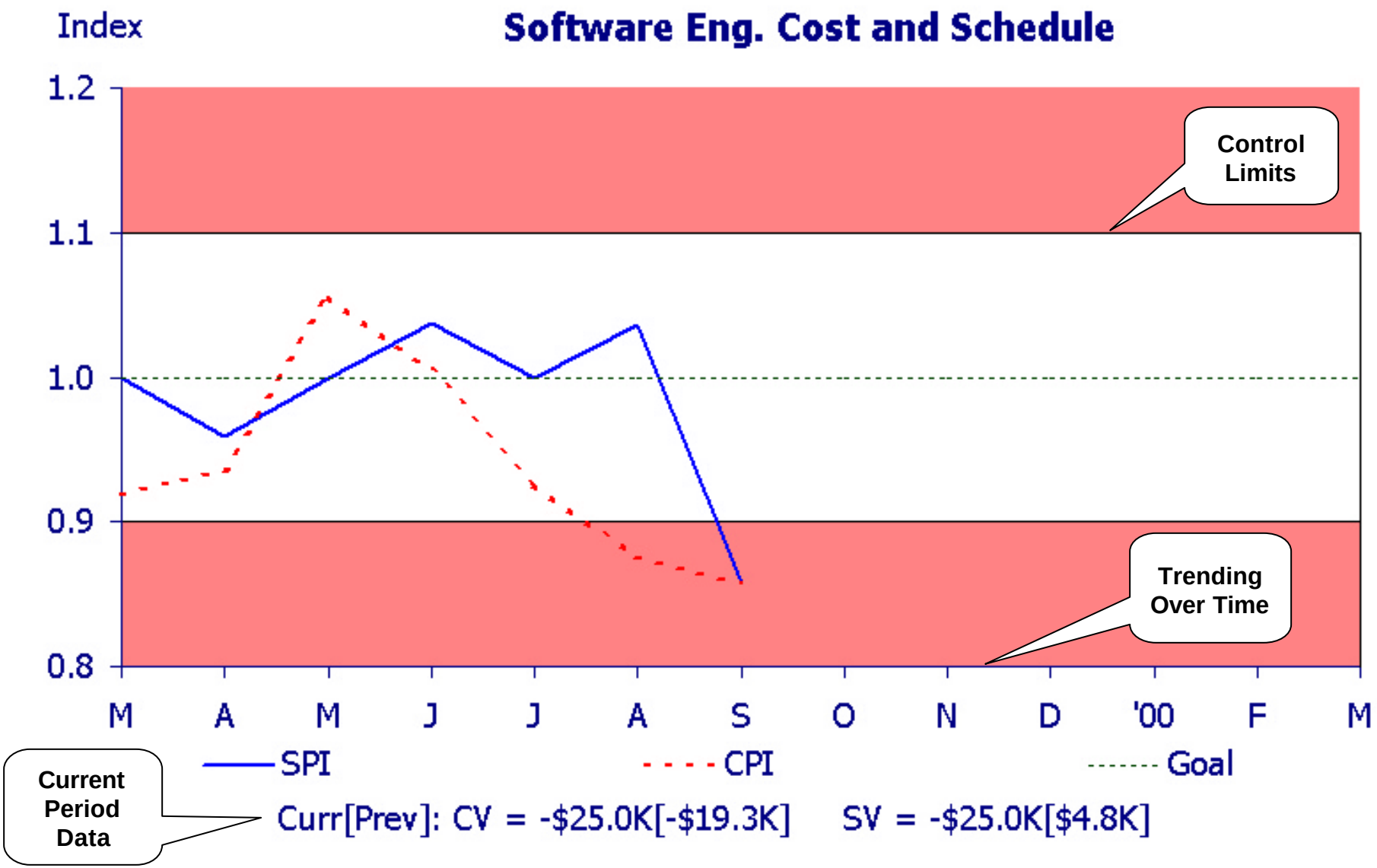
Control Panels display one or more frames

Reports contain one or more control panels



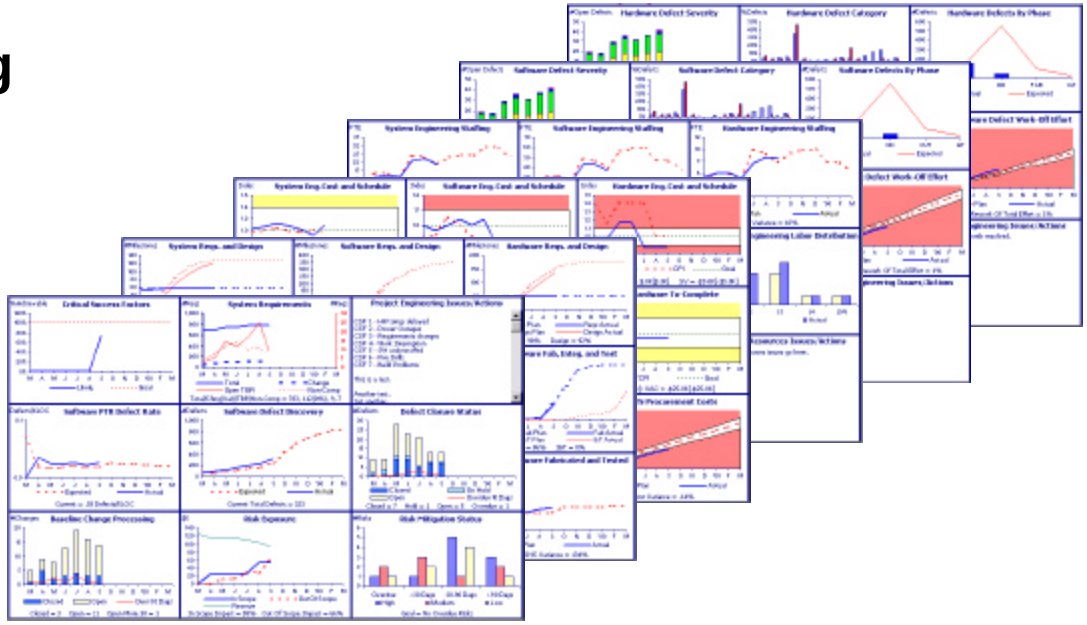
Metrics are composed of measures

Measures are units of measurement


Index
Software Eng. Cost and Schedule
1.2
1.1
1.0
0.9
0.8
Control Limits
Trending Over Time
M A M J J A S O N D '00 F M
SPI
CPI
Goal
Current Period Data
Curr[Prev]: CV = -$25.0K[-$19.3K] SV = -$25.0K[$4.8K]

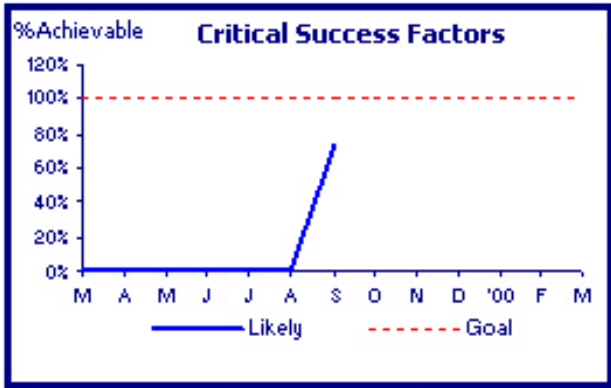
Control Panels

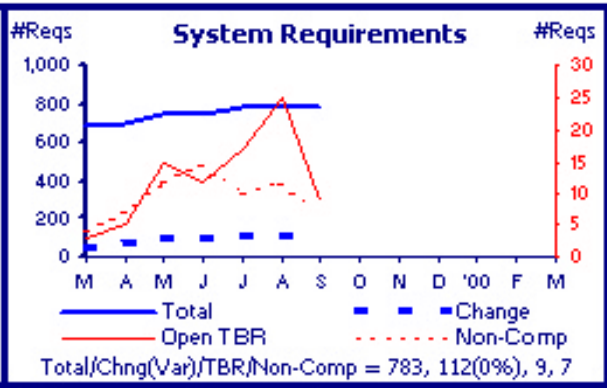
- **Integrated Engineering**
  - System
  - Software
  - Hardware
- **On-line References**
- **Project Tailoring**
  - Custom Panels
  - Control Limits
- **Project Compliance**
  - Performance
  - Progress
  - Cost and Schedule
  - Resources
  - Software Performance
  - Hardware Performance
- **Management Review**

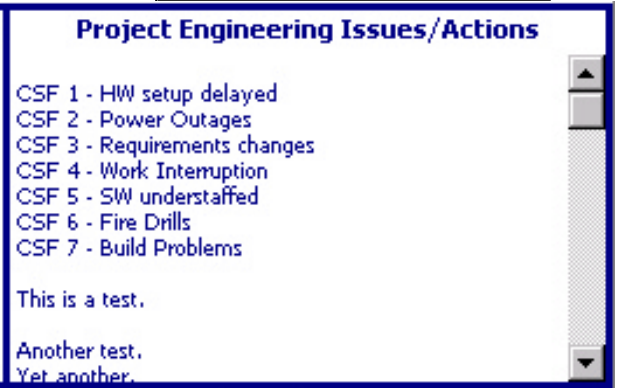


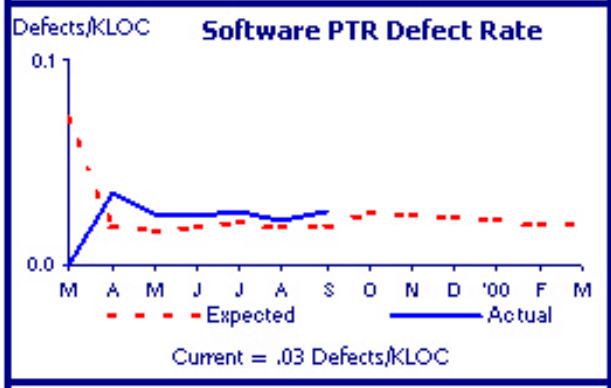
- System Stability, Quality, Risks
- Milestones, Completeness
- Cost & Schedule Variance
- Staffing, Training, Tools
- Software Quality, Size, Stability
- Hardware Quality, Size, Stability

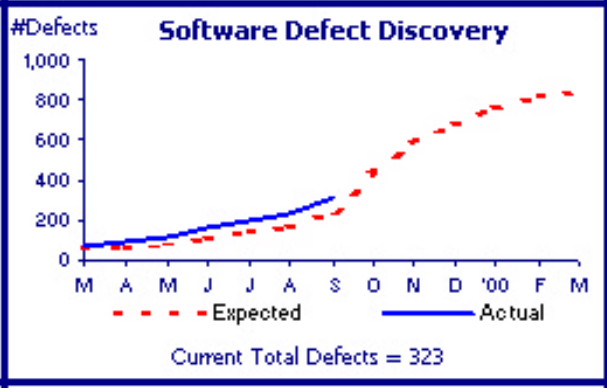
Engineering Performance

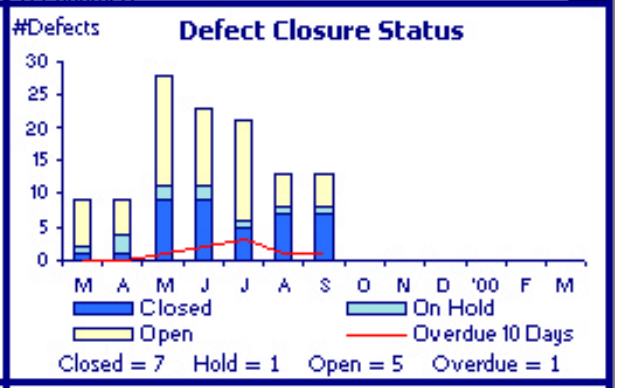


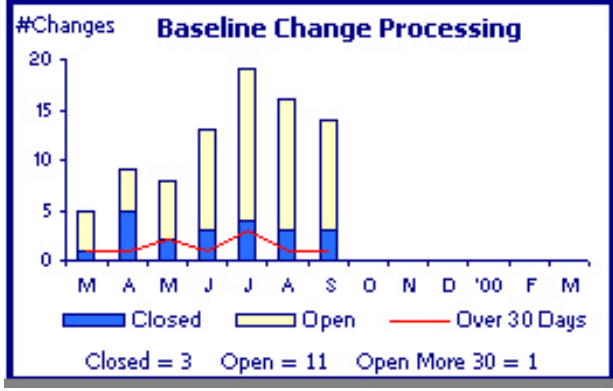


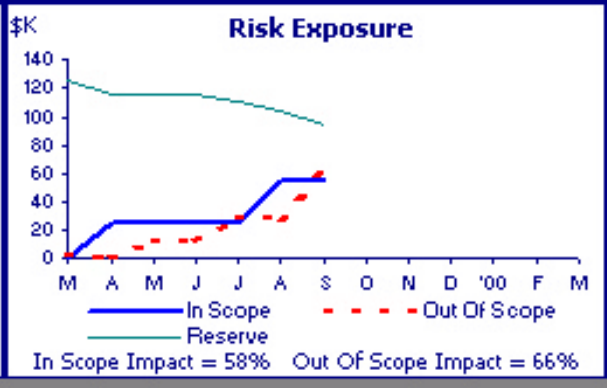


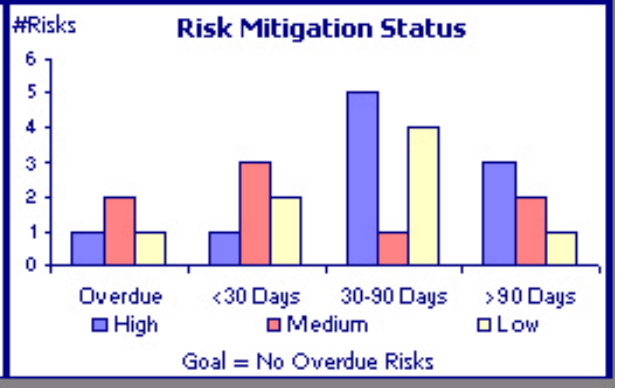




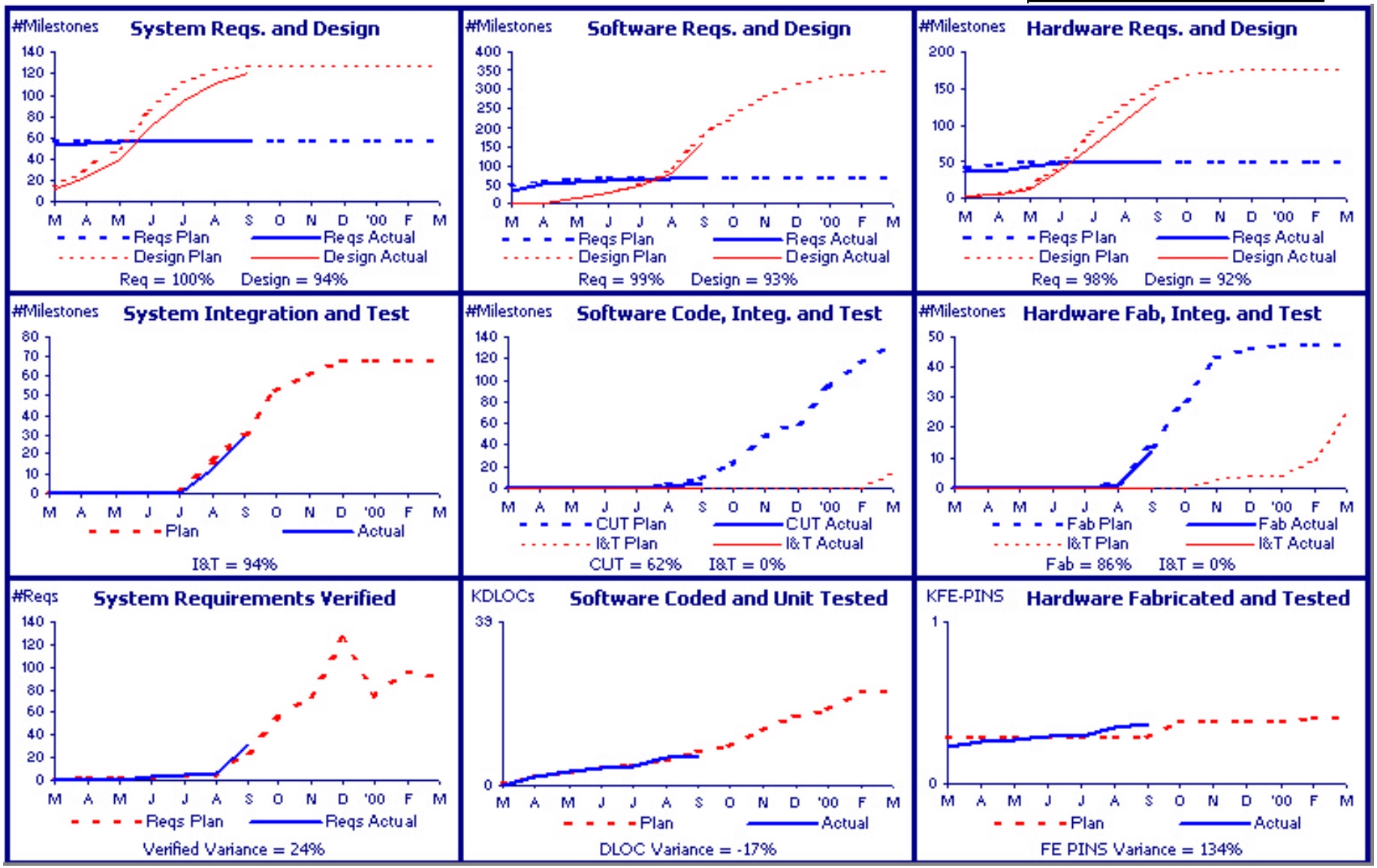




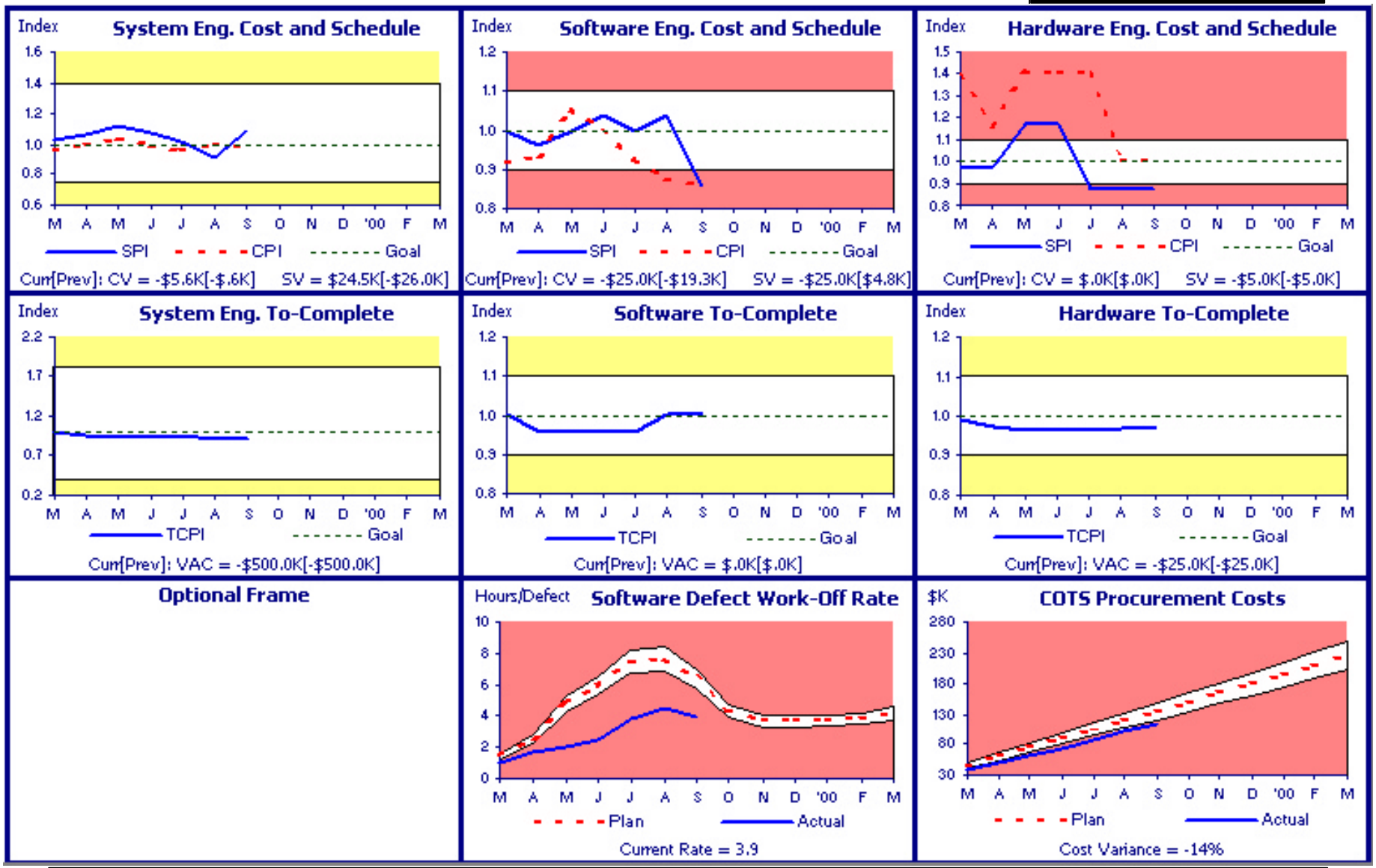




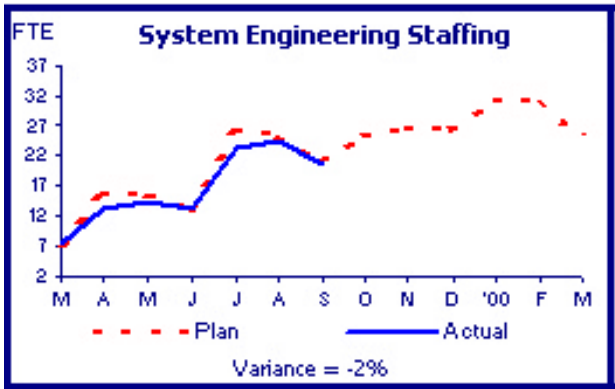
Engineering Progress

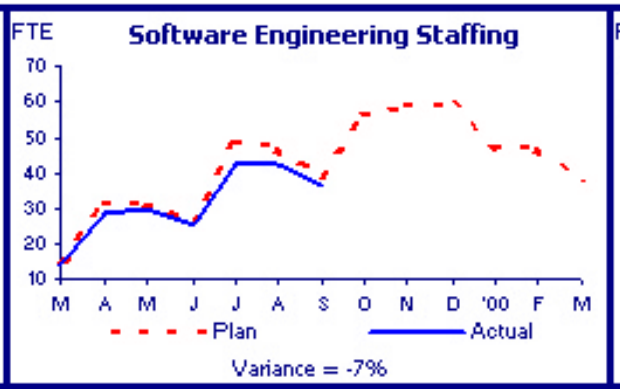


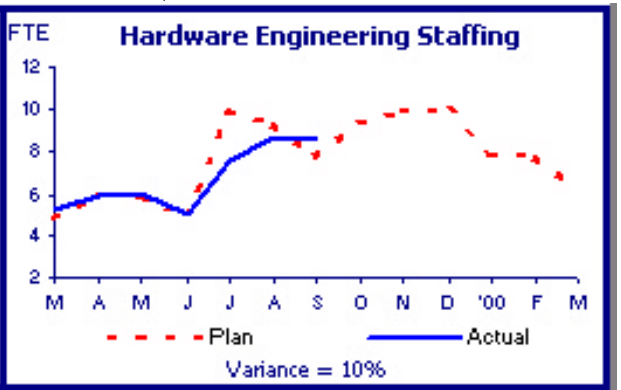
Engineering Cost & Schedule

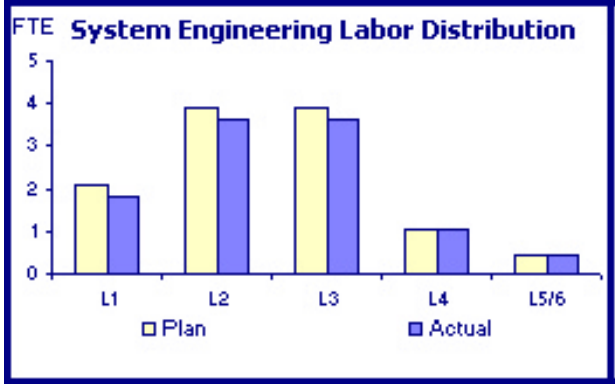


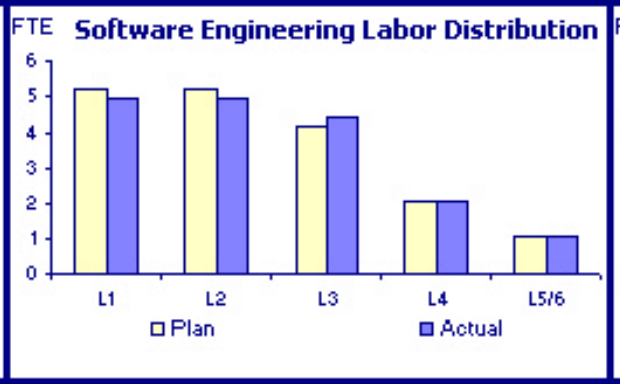
Engineering Resources

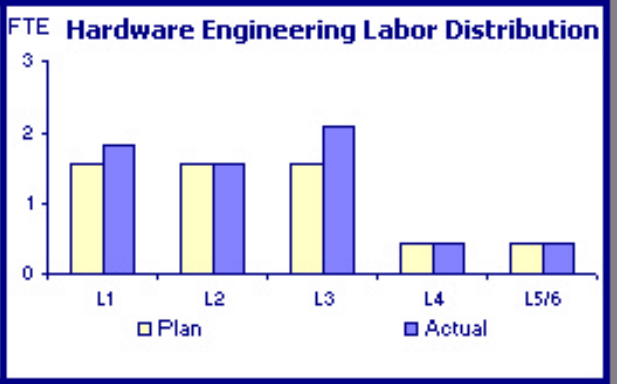


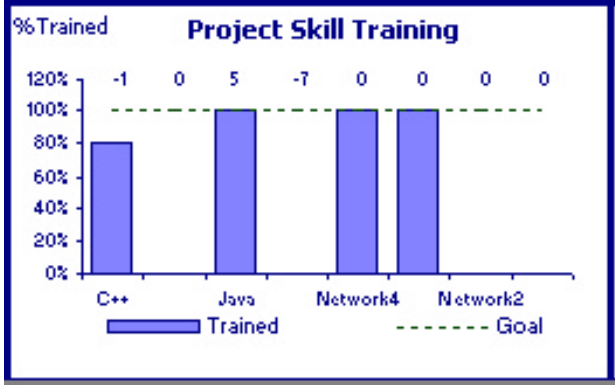


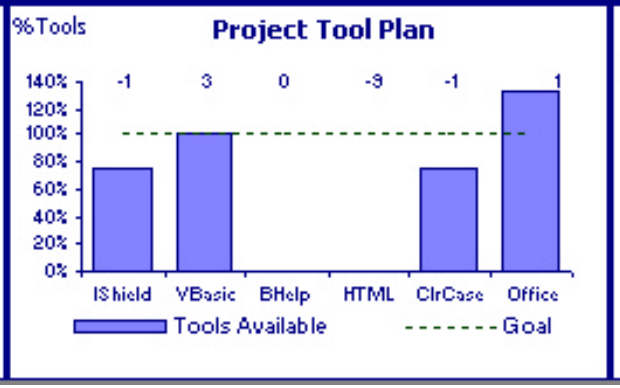








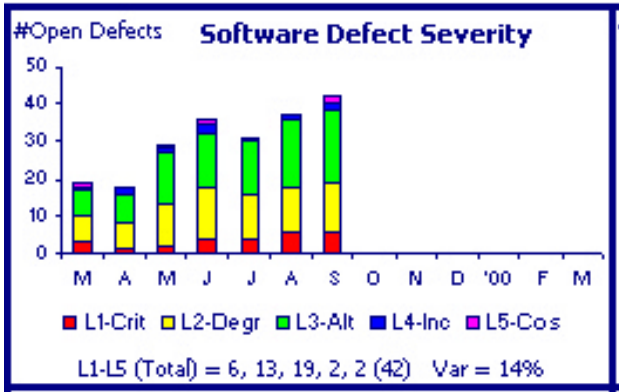


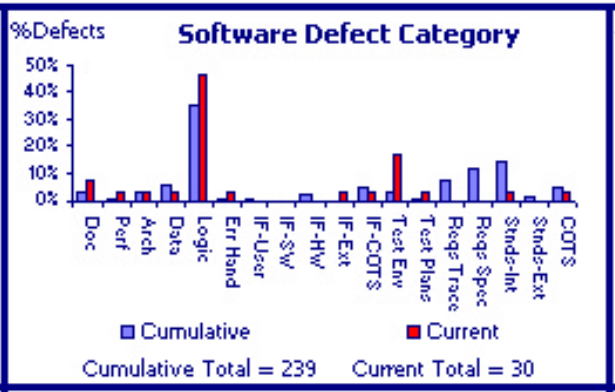


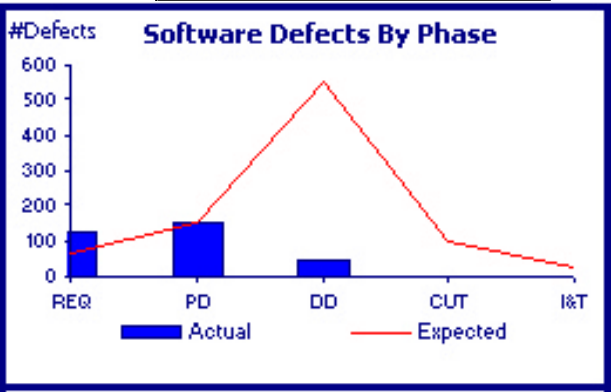
Engineering Resources Issues/Actions

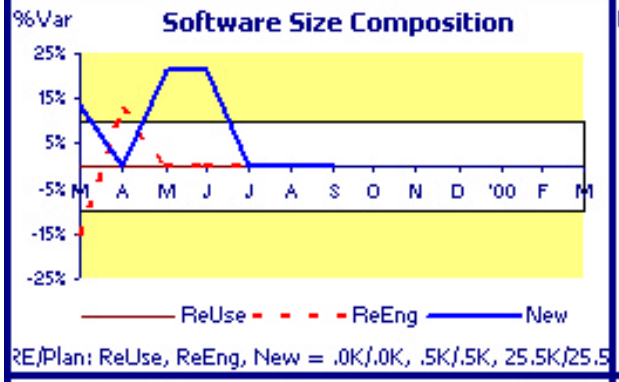
The Engineering Resources issues go here.

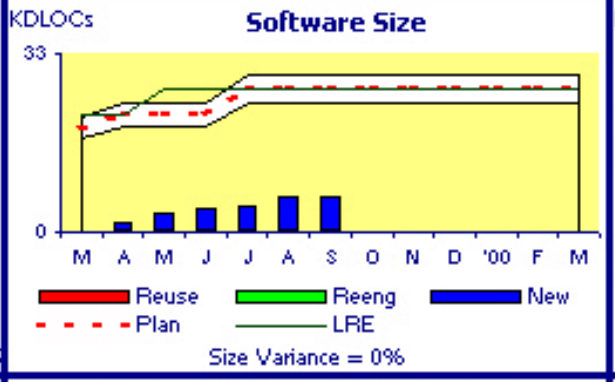
Software Performance

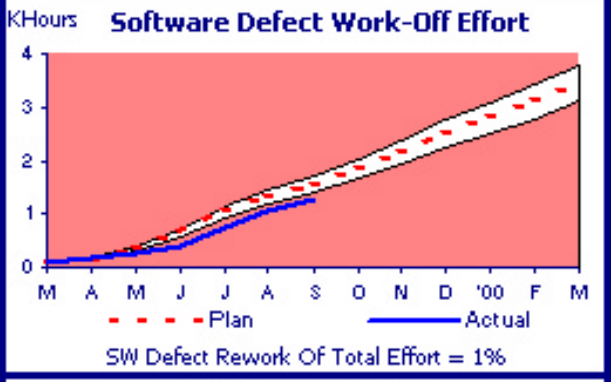


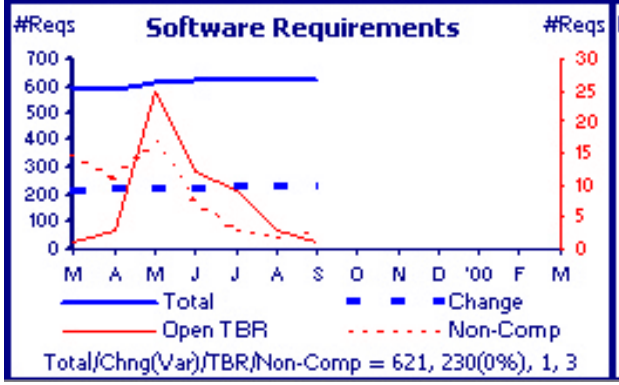


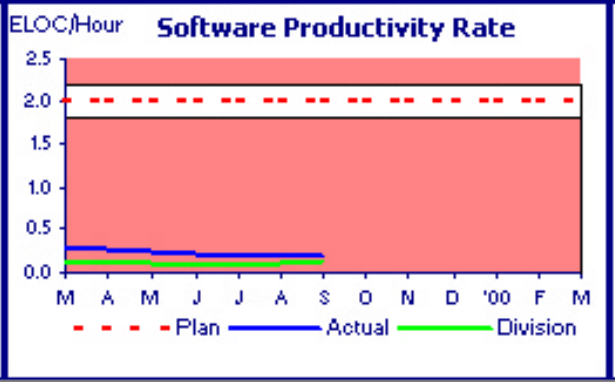








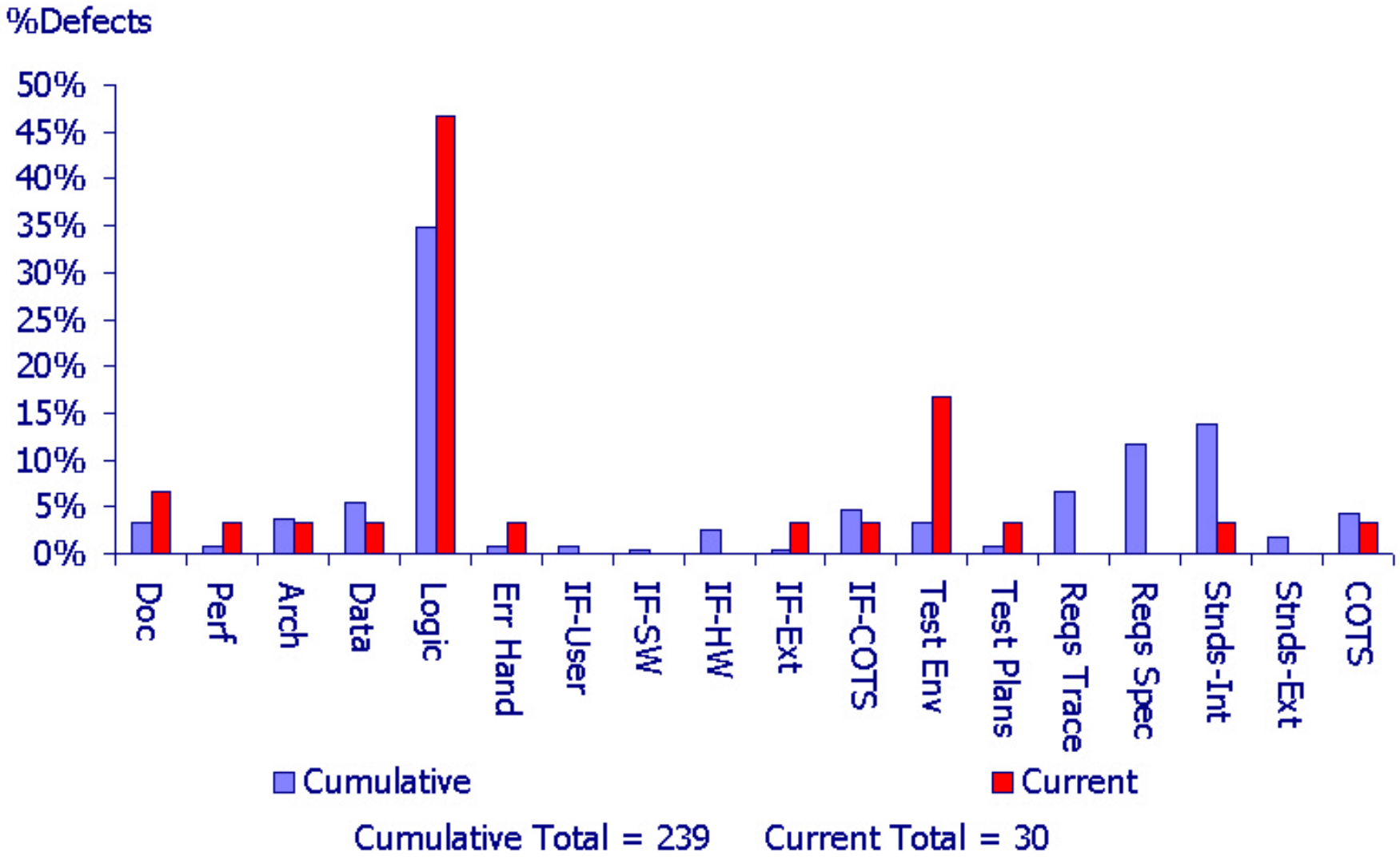




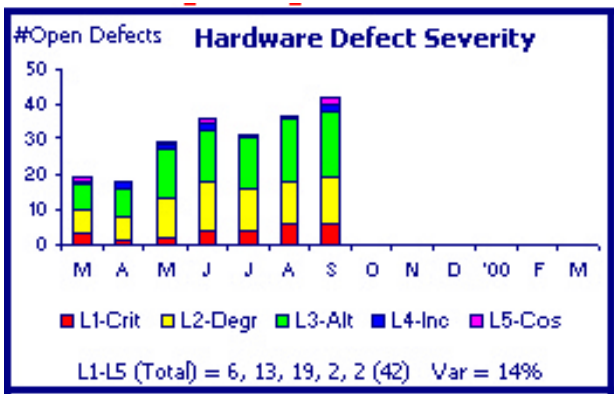
Software Engineering Issues/Actions

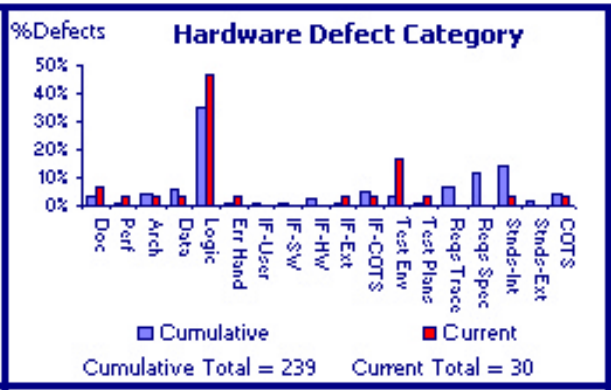
1. The first issue
2. The second issue
3. The third issue

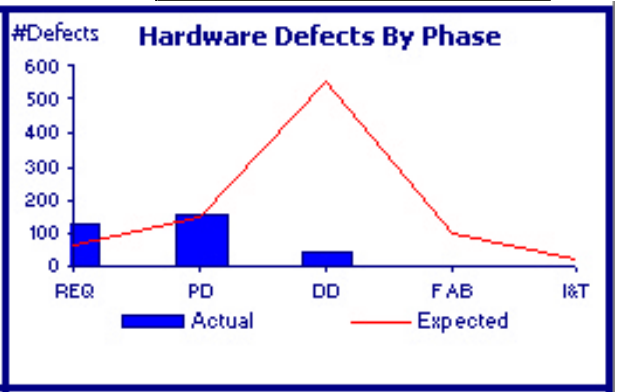
Software Defect Category (Zoom)

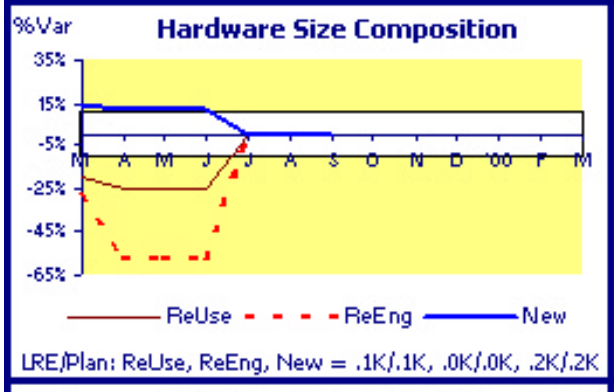


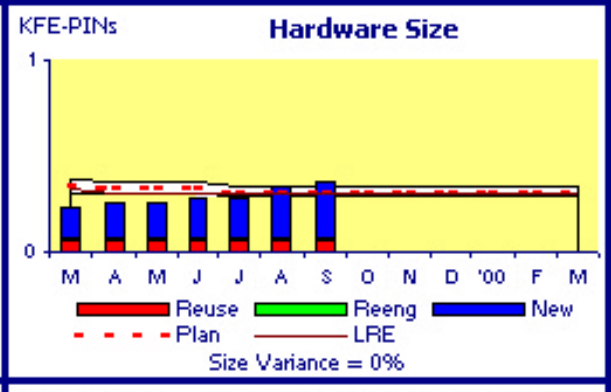
Hardware Performance

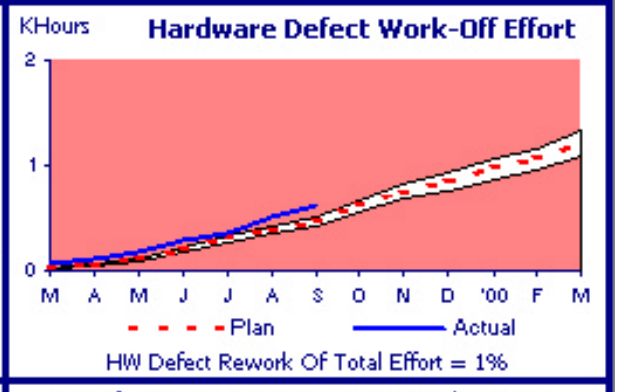


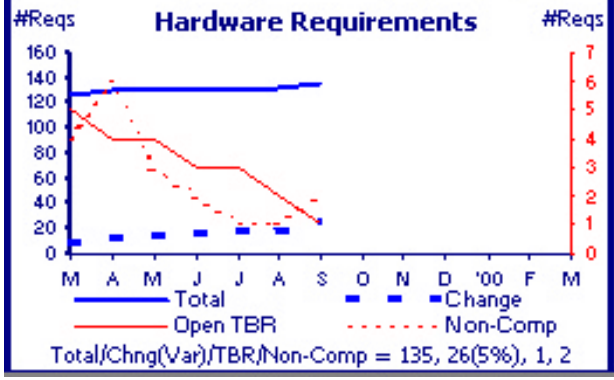


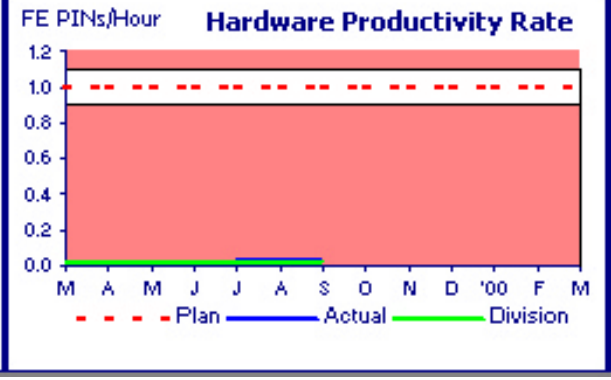












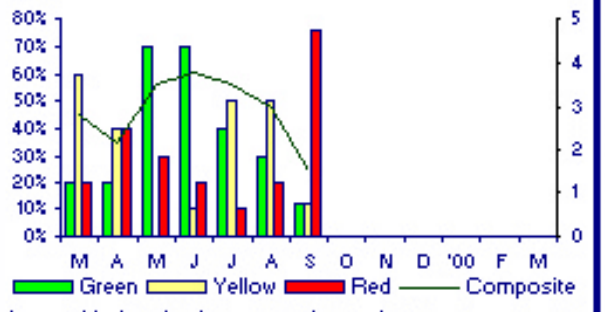
Hardware Engineering Issues/Actions

All issues from last month resolved.

Management Review

HARRIS

Status **Technical Performance Measures** Score



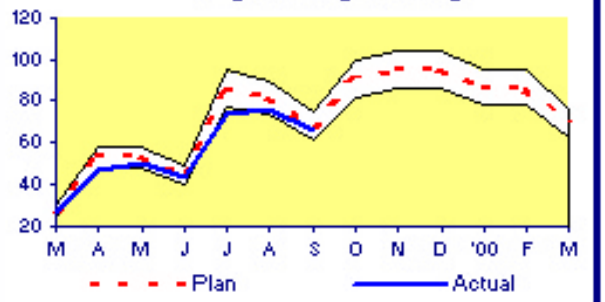
(Overridden) G / Y / R = 12% / 12% / 76% Comp = 1.50

Key TPMs

PARAMETER	SPEC	CURRENT	TREND	
Vehicle Weight	1560 lbs	1560 lbs	↓	Y
Power LRU #6	1.25 KW	1.37 KW	↑	R
Power LRU #5	1.25 KW	1.23 KW	↓	G
C-Band Xmit SNR	92 db	93 db	↓	Y
KU -Band Output Po	2kw	1.68 KW	↓	R
CSCI #1 Memory Uti	75%	12%	↑	G
CSCI #1 CPU Utiliza	50%	20%	↑	G
CSCI #2 Memory Uti	75%	66%	↑	Y
CSCI #2 CPU Utiliza	50%	67%	↑	R
FPGA Gate Util	75%	88%	↑	R

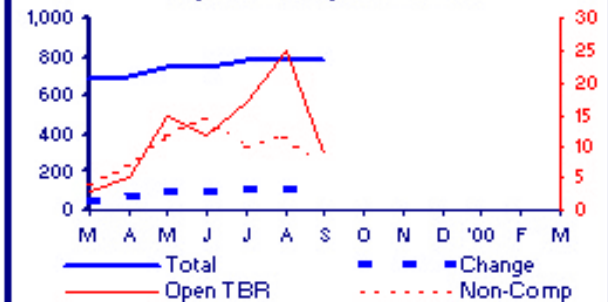
Optional Frame

FTE **Engineering Staffing**



Variance = -3%

#Reqs **System Requirements** #Reqs



Total/Chng(Var)/TBR/Non-Comp = 783, 112(0%), 9, 7

Optional Frame

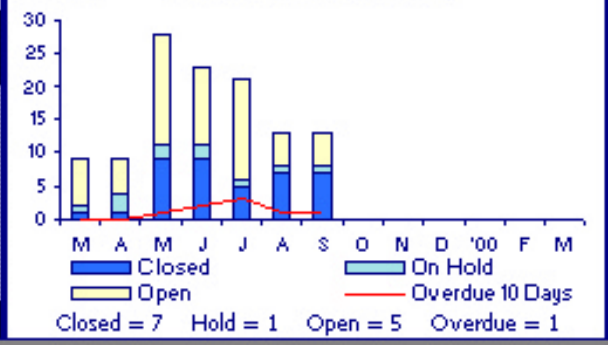
Project Engineering Issues/Actions

CSF 1 - HW setup delayed
CSF 2 - Power Outages
CSF 3 - Requirements changes
CSF 4 - Work Interruption
CSF 5 - SW understaffed
CSF 6 - Fire Drills
CSF 7 - Build Problems

This is a test.

Another test.
Yet another.

#Defects **Defect Closure Status**



Closed = 7 Hold = 1 Open = 5 Overdue = 1

Optional Frame

Lessons Learned

- One metric doesn't tell the whole story
  - Need an integrated and many times orthogonal views
  - Trending is key
- Project planning is key
- Data collection is the hardest
- Having a standard tool is highly desirable
  - Consistency
  - User friendly
  - Easy access
- Training is a must
  - Cultural change is hard
  - Train everything -- even the obvious

Contact Information

Gary Natwick
Harris Corporation
P.O. Box 37
Melbourne, Florida 32902-0037

gnatwick@harris.com
http://www.harris.com/
321-729-3970

References

• Robert E. Park, Wolfhart B. Goethert, William A. Florac, “Goal-Driven Software Measurement - A Guidebook”, Software Engineering Institute, CMU/SEI-96-HB-002, August 1996

• Mark C. Paulk, Charles V. Weber, Suzanne M. Garcia, Mary Beth Chrissis, and Marilyn W. Bush, "Key Practices of the Capability Maturity Model®, Version 1.1", Software Engineering Institute, CMU/SEI-93-TR-25, February 1993

• CMMI℠ for Systems Engineering/Software Engineering, Version 1.02, Staged Representation, Carnegie Mellon University, CMU/SEI-2000-TR-028, December 2000